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(54) **Seat-height adjustment mechanism**

(57) Two frames, one 11 connected directly or indirectly to the floor (for example, of a motor car) and the other 10 connected directly or indirectly to the seat, are connected to one another by scissors-connected levers 12, 13. Spring means, for example a tension or compression spring 25 or a gas spring, act between said two frames and tend at all times to move the seat upwardly relatively to the floor. A seat-height setting, selected from a number thereof by the seat user, is maintained by multi-pronged (21) catch levers 22 engaging holes in racks 19.

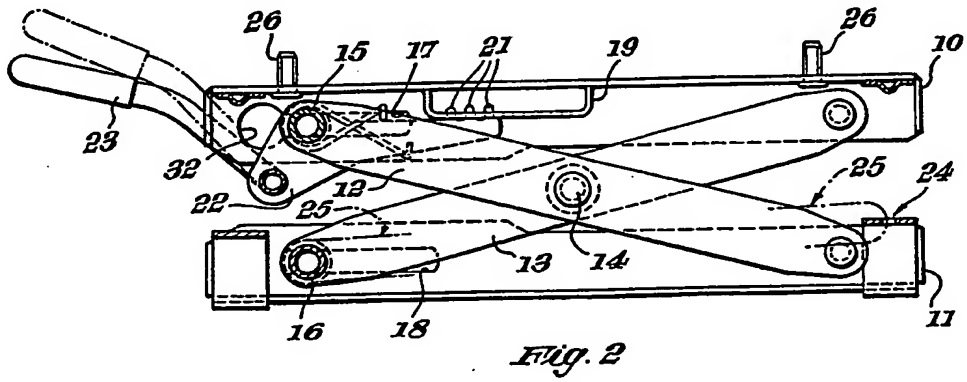

Fig. 2

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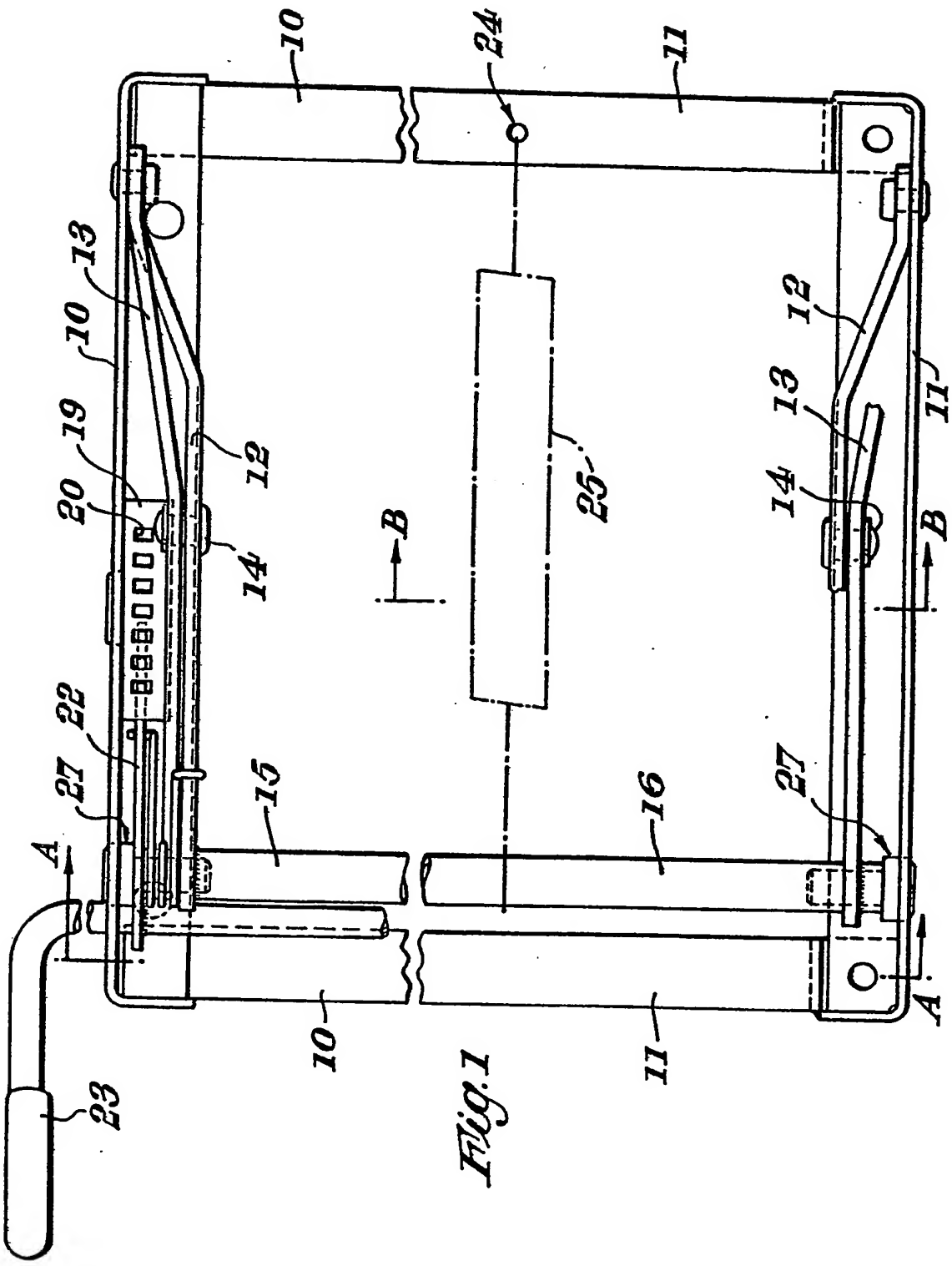

Fig.1

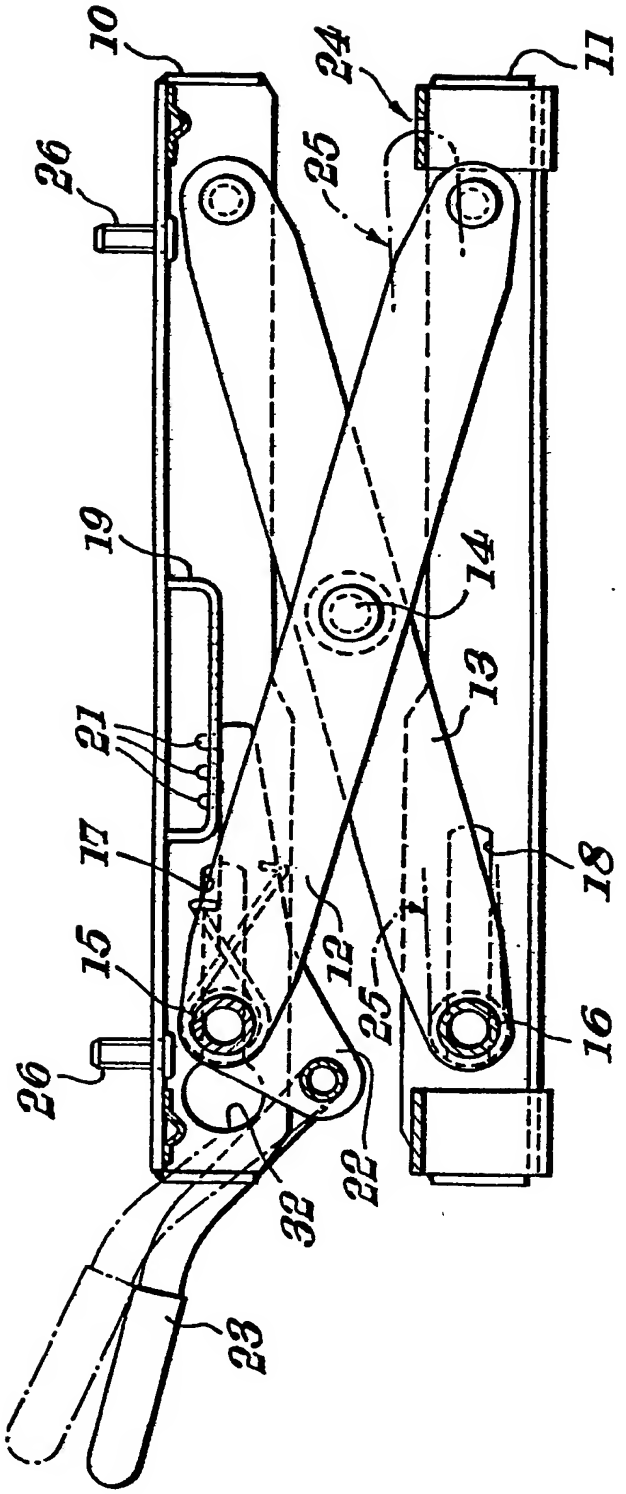

Fig. 2

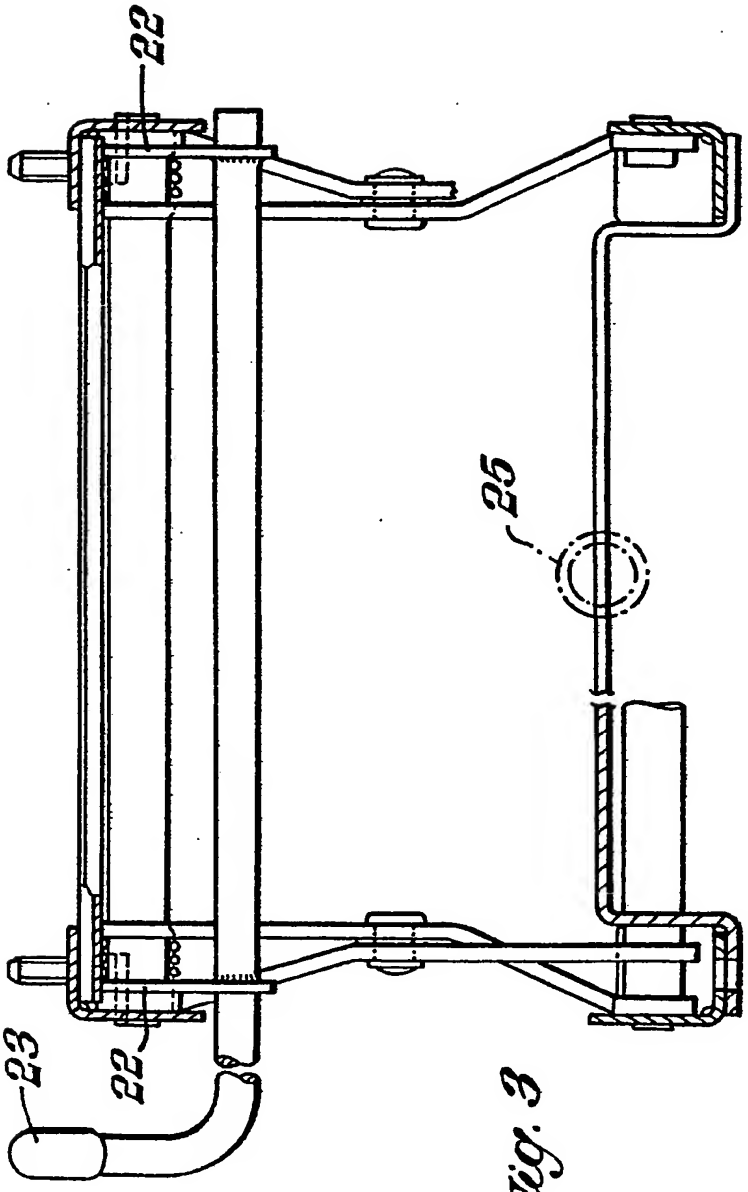

Fig. 3

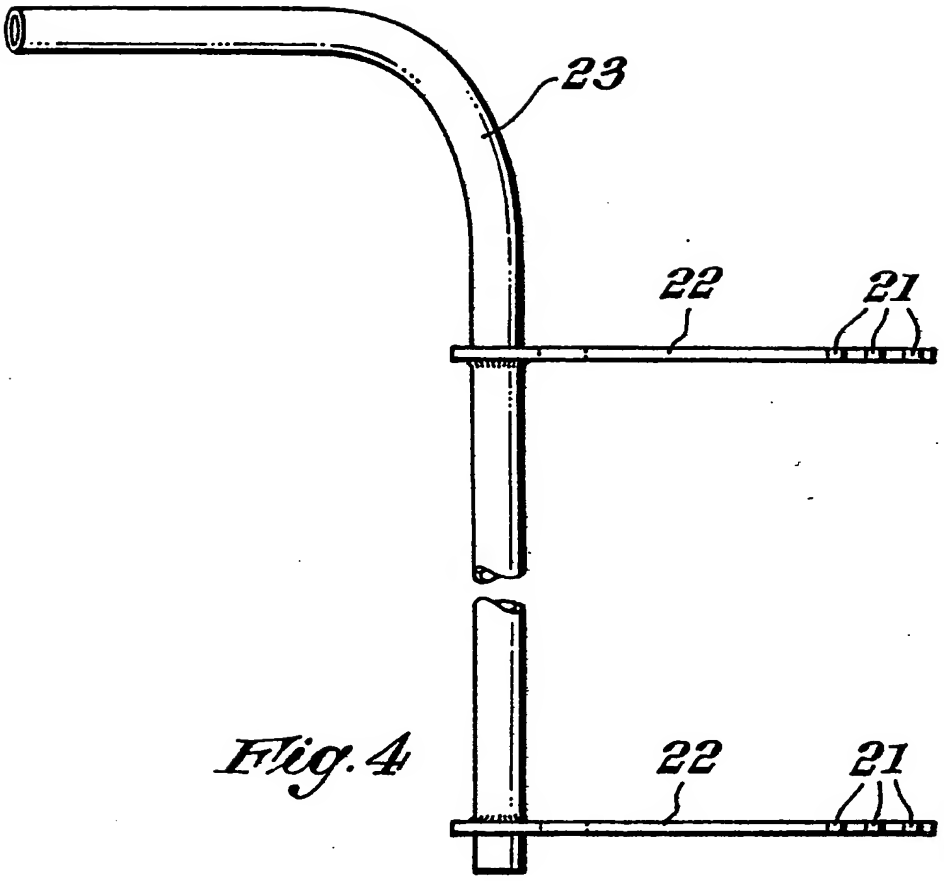

Fig. 4

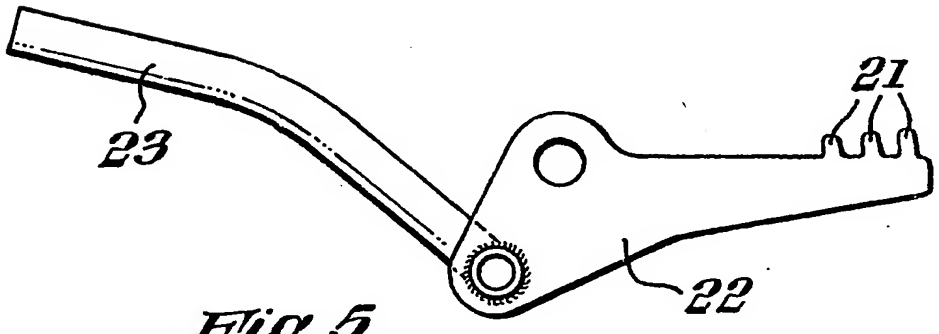

Fig. 5

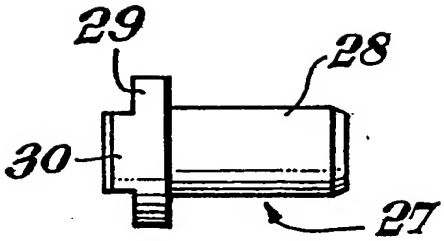

Fig. 6

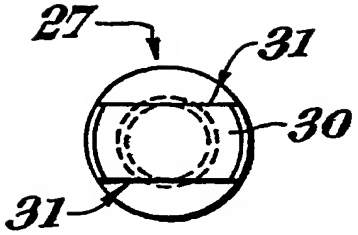

Fig. 8

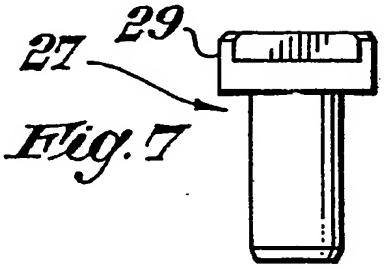

Fig. 7

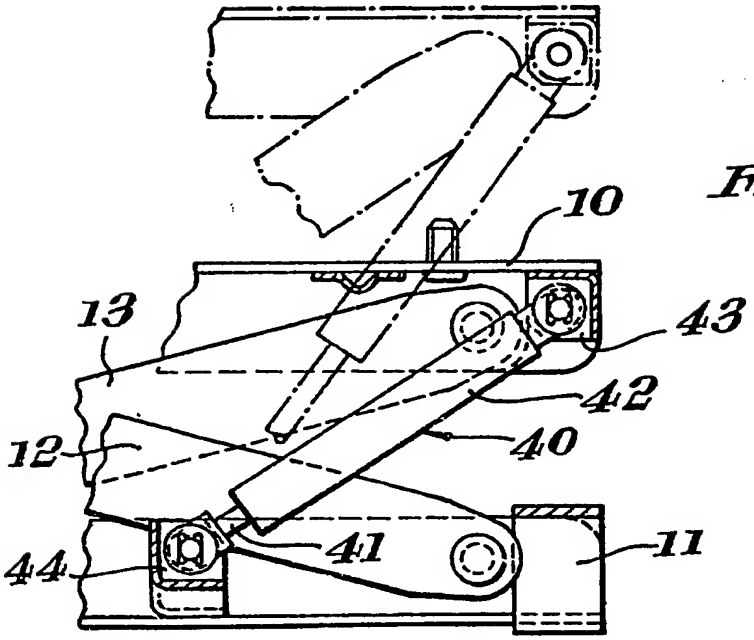

Fig. 9

SPECIFICATION

Seat-height adjustment mechanism

This invention relates to a seat-height adjustment mechanism and to a seat equipped with such a mechanism.

According to a first aspect, the present invention consists in a mechanism for adjusting the height of a seat relatively to a datum line, said mechanism comprising two horizontally spaced pairs of levers of which the levers in each pair are connected to one another in the manner of scissors; each lever of each pair having an upper end and a lower end of which the upper end is connected to the seat and of which the lower end is connected to the floor; spring means tending at all times to cause the seat to move relatively to the floor, and catch means adapted to secure the seat at any one of a number of heights above floor level at a time.

Said catch means may include manually operable catch levers having prongs engaged in racks.

In one embodiment of said mechanism, said spring means is a tension spring of which one end if anchored to a part which is directly or indirectly attached to the floor and of which the other end is anchored to another part which is directly or indirectly attached to the seat.

In a generally preferred embodiment of said mechanism, said spring means is a gas spring which acts between a part which is directly or indirectly attached to the floor and another part which is directly or indirectly attached to the seat.

In the particular case in which the seat described in either of the two preceding paragraphs is installed in a vehicle (for example, as one of the front seats in a motor car), it is preferred for the pairs of scissors—connected levers to be so arranged as to extend in a fore-to-aft direction in, as distinct from transversely of, the vehicle.

According to a second aspect, the present invention consists in a seat which is directly or indirectly connected to a floor by means of two pairs of levers, each lever of each pair having an upper end connected to the seat and a lower end connected to said floor and being pivotally connected at a point between said ends to a corresponding point on the other lever of the respective pair, and catch means operable to hold the seat at any one of a number of heights to which it can be moved in a generally vertical direction relatively to said floor, said catch means consisting of racks each of which is adapted to be engaged by at least two prongs in order to maintain said seat at the height to which it has been adjusted.

The seat described in the preceding paragraph may be urged at all times towards that height setting thereof which is farthest from the floor by spring means which is anchored at one end to said seat and at the other end thereof to the floor. Said spring means may be a tension spring or a gas spring.

The mechanism and the seat described in the four preceding paragraphs do not have any elevating/lowering mechanism such, for example, as that described and illustrated in United Kingdom Patent Specification No. 1,375,931. This is of benefit in the field of motor vehicles because it not only reduces cost to the customer but also reduces vehicle weight, and nowadays vehicle weight is a very important consideration with vehicle manufacturers and the purchasing public in view of fuel consumption and fuel costs.

Although not described in the preceding paragraphs, it is considered preferable to mount the seat and the attached seat-height adjustment mechanism upon parallel slide/rail assemblies in order also to facilitate forwards/backwards adjustment of the seat relatively to the front of the vehicle, but, of course, this is not essential. An alternative would be to mount the seat-height adjustment mechanism directly on the floor and to mount the seat and its attached parallel slide/rail assemblies on the top of said mechanism. Lastly, the seat could be mounted on the floor by means of the seat-height adjustment mechanism and without provision of any of the customary parallel slide/rail assemblies.

Two embodiments of a seat-height adjustment mechanism according to the present invention and suitable for installation, for example, in a motor vehicle will now be briefly described with reference to the accompanying drawings, in which:—

Figure 1 is a plan view of a first embodiment of a seat-height adjustment mechanism according to the invention, the upper portion of said Figure being a composite view of a top frame and one of two locking mechanisms mounted thereon, and the lower portion thereof being a view in which the top frame has been cut away to reveal a lower frame;

Figure 2 is a side elevation, partly in section, showing one of two pairs of pivotally connected levers (one of said pairs being mounted at each side) together with said one locking mechanism which operates to keep the seat in the raised or lowered position which has been chosen;

Figure 3 is a composite view showing respectively a section on the line A-A of Figure 1 and a smaller section taken on the line B-B of Figure 1;

Figures 4 and 5 illustrate, in plan and in side elevation, respectively, two catch levers mounted parallel to one another and secured to a common operating handle;

Figures 6, 7 and 8 are various views of a component of the mechanism; and

Figure 9 is a scrap-view, similar to the corresponding portion of Figure 1, of a second embodiment of said mechanism.

Referring to Figures 1 to 9, it should be understood that the mechanisms disclosed therein will preferably be mounted upon another mechanism by means of which the position of the seat relatively to the front of the vehicle can be adjusted, such other mechanism could be made in accordance with co-pending Patent Application No. 82.13135 but it is to be understood that any suitable other mechanism could be employed in place thereof.

The mechanism illustrated in Figures 1 to 8 of the accompanying drawings consists essentially of two vertically spaced rectangular frames 10, 11 which are connected to one another by means of two pairs of levers 12, 13, the levers in each pair being pivotally connected to one another in the manner of scissors by

a pin 14, th re being one pair f lev rs 12, 13 at each side of th frames 10, 11. The ends of the levers 12, 13 are connected to the frames in such a manner that the frame 10 can be moved relatively to the frame 11 upwardly or downwardly. In order to achieve this, the lower end of the lever 12 is pivotally connected to the frame 11 and the upper end of the lever 13 is pivotally connected to the frame 10, whereas the upper end of the lever 12 and the lower end of the lever 13 are connected to respective parallel transverse shafts 15, 16 which are able to and are intended to move along elongate slots 17, 18 which are formed in the respective frames 10, 11.

The frame 10 carries two racks 19 and each rack, in the particular embodiment illustrated, is provided with seven holes 20 which are aligned with one another in the fore-to-aft direction and into which there are arranged to project three teeth 21 formed near to one end of the respective one of a pair of spring-urged catch levers 22 each of which is pivotally mounted on the shaft 15. Connected (for example, by welding) to the levers 22 is a handle 23 whose free end is so placed that the seat occupant can easily reach it whilst in normal sitting position and without the degree of contortion which is sometimes necessary when adjusting seat mechanisms of various kinds.

The frame 11 is provided with a suitable anchorage point 24 for one end of a powerful tension spring 25 whose other end is anchored to or engages the shaft 16.

It will be assumed that the mechanism enabling fore-to-aft movement of the seat (see for example our co-pending Application No. 82.13135) has been installed in the vehicle with the mechanism illustrated in the accompanying drawings connected to the so-called seat-slide; the actual seat in or on which a person can sit has not been illustrated but will be mounted on the frame 10 by means of fixing bolts 26 of a usual kind and nuts or other securing means (not illustrated). It will also be assumed that a person is sitting on the seat and wishes to adjust the height of the seat relatively to vehicle floor level in an upwards direction. The frame 10 has been drawn in full lines in Figure 2 in that position thereof in which it is at minimum height above the top of the seat slide. The seat occupant will operate the handle 23 by pulling it upwardly (that is, in a clockwise direction as seen in Figure 2) in order to cause the two sets of teeth 21 on the two levers 22 to be moved simultaneously out of engagement with the respective sets of three of the holes 20 in the two racks 19. When said teeth have been thus disconnected from the racks 19, the occupant of the seat can cause his or her weight to be temporarily removed from the seat (for example, either by transferring the weight to shoulders and feet or by simply lifting that weight by means of a grab handle in the vehicle) and the power stored in the stretched tension spring 25 will act on the transverse shaft 16 (or other anchorage) and will pull that shaft towards the right as seen in Figures 1 and 2. The opp site ends of that shaft 16 are c nnected t corresponding ends f th respective levers 13 of said tw pairs f l vers and consequently the two levers of each lever pair are pened ut in such a manner that, for example, the frame 10 is lift d int the p sition thereof which is drawn in interrupted lin s in Figur 2; that particular illustrated raised p siti n of th frame 10 happens t be at the maximum height to which th mechanism can be adjusted but there are, in this particular embodiment, three other height settings to which said frame can be adjusted. Having reached the height which best suits the seat occupant, that person will release the handle 23 connected to the spring-urged levers 22 in order to permit the teeth 21 on the respective levers 22 to engage the respective sets of three of the holes 20 in said two racks 19.

Thus adjusted, the entire weight of the seat occupant can be lowered on to the seat again and the seat will be held at its adjusted height.

The provision of the two horizontally spaced racks 19 and the two spaced catch levers 22 with their teeth 21 ensures stability of the mechanism.

It is stated above that the spring 25 is a tension spring but it will be understood that a compression spring could be used with equal effect.

Although it will be preferred that the pairs of pivotally connected levers 12, 13 will extend in the usual direction (namely, from front to back in relation to the vehicle) it would be possible for the lever pairs to extend transversely. Thus positioned, the handle 23 connected to the levers 22 will still need to be placed in the same position relatively to the seat occupant and this would easily be achieved by any competent engineer.

Reverting to the elongate slots 17, 18, the hollow shafts 15, 16 have sliding studs 27 inserted into their open ends; each stud 27 (see Figures 6 to 8) includes a right cylindrical portion 28 and a conjoined head 29 which is shaped to provide a projection 30 having parallel flanks 31. The projection 30 of each sliding stud extends into the respective slot 17, 18 and guides and limits the movements of the shafts 15, 16.

The slots 17 at the two sides of the upper frame 10 are longer than the slots 18 in the lower frame because they are provided with enlarged ends 32. The purpose of these enlarged ends is to facilitate assembly, the ends of the hollow shaft 15 being lined up with said enlarged ends 32 to permit insertion of the sliding studs 27. This operation is carried out prior to rivetting the cross levers 12, 13 together to provide the pivot 14. As regards the lower frame 11, the sliding studs 27 are inserted into the opposite ends of the hollow shaft 16 prior to assembly into the slots 18; said shaft 16 and its sliding studs 27 are offered into the lower frame diagonally in order to permit clearance and, once the projections 30 are engaged into said slots 18, the assembly of shaft 16/studs 27 is then squared up.

It must be stressed again that the seat-height adjustment mechanism will preferably be used in conjunction with the other means which enable the seat position to be moved longitudinally of a vehicle, but said other means may be omitted in order to provide the seat with height adjustment only.

Referring to Figure 9 of the drawings, a generally preferred emb diment f an adjustable height mechanism is illustrat d which is the same as that d scribed above with refer nce to Figur s 1 to 8 exc pt that the tension spring 25 (or th alt rnative compression spring) is replaced by a gas spring 40. Said gas spring is provid d with tw fixing eyes of which one is integral with th axially outer nd of the

piston rod 41 and f which the other is integral with the closed end of the pressur cylinder 42. The frame 10 is provided with a suitably shaped and strong mounting member 43 to which the pressure cylinder eye is connected and the frame 11 is provided with a suitable shaped and strong mounting member 44 to which the piston rod eye is connected. Gas springs have been known for over twenty years and it is, therefore, not considered to be necessary to describe the manner in which they operate; it is only necessary to state that the spring continually exerts a force tending to extend the piston rod. An advantage obtained by the use of a gas spring in the mechanism according to the invention is that, in addition to the action of the spring to lift the seat upwardly unless restrained from doing so by the teeth 21 engaging the holes 20, a certain amount of damping is provided by the gas spring on closing. This damping is desirable because it prevents the mechanism from closing (lowering the seat) suddenly and therefore prevents the occupant of the seat from coming to rest with a bump. The particular gas spring employed in said generally preferred embodiment is the LIFT-O-MAT (Trade Mark) gas spring manufactured and marketed by Stabilus G.m.b.H. of Koblenz, Federal Republic of Germany but other gas springs may well be as satisfactory.

CLAIMS

1. A mechanism for adjusting the height of a seat above a datum line, said mechanism comprising two horizontally spaced pairs of levers of which the levers in each pair are connected to one another in the manner of scissors; each lever of each pair having an upper end and a lower end of which the upper end is connected to the seat and the lower end is connected to the floor; spring means tending at all times to cause the seat to move relatively to the floor; and catch means adapted to secure the seat at a number of heights, one at a time, above floor level.

2. A mechanism as claimed in Claim 1, wherein said catch means includes manually operable catch levers having prongs engaged in racks.

3. A mechanism as claimed in Claim 1 or Claim 2, wherein said spring means is a gas spring whose pressure tube and piston rod have fixing means enabling the respective parts of said gas spring to be connected to said seat and said floor.

4. A mechanism as claimed in Claim 1 or Claim 2, wherein said spring means is a tension spring whose opposite ends are anchored to a part which is directly or indirectly attached to the floor and to another part which is directly or indirectly attached to the seat.

5. A mechanism as claimed in any one of the preceding Claims, wherein the pairs of scissors—connected levers are so arranged as to extend in a fore-to-aft direction in the vehicle.

6. A seat which is directly or indirectly connected to a floor by means of two pairs of levers, each lever of each pair having an upper end connected to the s at and a lower end connect d to said floor and being pivotally connected at a p int betw en said ends to a corresponding point on the other lever f th respective pair, and catch means operable to hold the seat at a number f heights, one at a tim , to which it can b moved in a generally vertical direction relatively t said floor, said catch means consisting of racks each of which is adapt d to be ngag d by at least two pr ngs in order to maintain said seat at th h ight to which it has been adjusted.

7. A seat as claimed in Claim 6, wherein the seat is urged at all times towards the height setting thereof which is farthest from the floor by spring means anchored at one end thereof to said seat and at the other end thereof to the floor.

8. A seat as claimed in Claim 6 or Claim 7, wherein said seat is mounted in a vehicle and is additionally movable in fore-to-aft directions in said vehicle relatively to the floor.

9. A seat as claimed in Claim 8, wherein the upper ends of the levers of each pair of levers are connected to a first frame and the lower ends of the levers of each pair are connected to a second frame, said first frame being secured directly to the seat and said second frame being secured to the vehicle floor by way of known parallel floor rail/seat slide units which are operable to provide said fore-to-aft movements.

10. A seat as claimed in Claim 8, wherein the upper ends of the levers of each pair of levers are connected to a first frame and the lower ends of the levers of each pair are connected to a second frame, said second frame being secured directly to the vehicle floor, and said first frame being secured to parallel rails which slidably engage complementary seat slides which are secured to the seat, the seat slides being movable in or on said rails in order to provide said fore-to-aft movements.

11. A mechanism for adjusting the height of a seat above a datum line, said mechanism being constructed, arranged and adapted to operate substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 8 or Figure 9 of the accompanying drawings.

12. A seat including a mechanism as claimed in Claim 11.

13. Any features of novelty, taken singly or in combination, of the embodiments of the invention hereinbefore described with reference to the accompanying drawings.

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